DOCUMENT RESUME

ED 227 330 CE 035 416

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TITLE	Determinants of Post-Training Attrition in the Army and Air Force.
INSTITUTION	Rand Corp., Santa Monica, Calif.
SPONS AGENCY	Office of the Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics (DOD), Washington, DC.
REPORT NO	Rand-P-6707
PUB DATE	Dec 81
NOTE	42p.
AVAILABLE FROM	The Rand Corporation, 1700 Main Street, Santa Monica, CA 90406 ($4.00).
PUB TYPE	Reports - Research/Technical (143)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Academic Aptitude; Dropout Research; *Dropouts; Educational Attainment; Family Status; *Individual Characteristics; Influences; *Military Personnel; *Military Training; Postsecondary Education; *Student Attrition; *Work Environment
IDENTIFIERS	*Air Force; *Army

ABSTRACT

A study was conducted to identify the separate influences of individual background characteristics and service environment on post-training attrition in the Army and Air Force. A second objective of the study was to determine whether the correlates of post-training attrition vary across services and military occupations. Data for the analysis of attrition behavior were obtained from the FY75 Cohort File created by the Defense Manpower Data Center. These data indicate that military occupation and duty location are significantly correlated with post-training attrition, after controlling for individual characteristics. Among individual characteristics, the research demonstrates that high school graduates have much lower post-training attrition rates than nongraduates and that participation in a delayed entry program prior to entering the military tends to reduce substantially the likelihood of attrition. Married recruits are less likely to leave early than single recruits, but the presence of children enhances attrition. Recommendations were made calling for more stringent accession screens, for changing personnel practices to reduce the incentives to leave high-attrition work environments and locations, and for either altering the mix of military occupations held or enhancing the attractiveness of high-attrition occupations. (MN)

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DETERMINANTS OF POST-TRAINING ATTRITION IN THE ARMY AND AIR FORCE

Richard Buddin

December 1981

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*Economist, The Rand Corporation. This paper is based on research funded by the Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics)--OASD(MRA&L). The author is grateful to G. Thomas Sicilia of OASD(MRA&L) for his continuing support and encouragement of Rand attrition research. The author is also indebted to John Antel and James Hosek at Rand for their comments on an earlier draft.

CE035416

P-6709

4.00

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I. INTRODUCTION

Since the end of the military draft in 1973, the military services have experienced unexpectedly high rates of first-term enlisted attrition. Recent experience has led military planners to expect nearly 40 percent of each accession cohort to leave before the end of their enlistment term. High attrition rates imply increased costs and policy adjustments throughout the military manpower system, and their effects pervade recruiting, training, force readiness and, ultimately, retention policies.

If the military is to ameliorate excessive attrition, it must develop improved methods of attrition management. To do so will require information on the separate effects of military environment and individual characteristics on the likelihood of attrition. Are some occupations or locations inherently attrition-prone? If this is so, it may be possible to change personnel practices to offer greater incentives for men to remain in them. Alternatively, is attrition high in some occupations or locations not because they are inherently unsatisfactory, but because military policy channels attrition-prone individuals into them? In that case, it would be more appropriate to consider alternative recruiting screens or manning configurations (e.g., more reliance on career enlisted personnel) to contain the attrition problem.

This research assesses the influence of military environment and individual background characteristics on the likelihood of post-training enlisted male attrition. Post-training attrition refers to recruits who complete their advanced individual training in a military occupational

speciality but leave the military before the end of their enlistment term. This aspect of attrition is considered important for two reasons. First, post-training attrition is costly to the services. It costs the services much more to lose a technically qualified specialist than to lose a trainee. Further, attrition shrinks the services' pool of specialists; to maintain manning at desired levels, the services may therefore have to devote more time, money, and personnel to recruiting, and often must offer greater enlistment incentives. Second, if the recruit finishes training without either "quitting" or being "fired" by the service, he enters the more steady-state post-training phase, which is more amenable to policy adjustments.

The study has two objectives. First, we would like to identify the separate influences of individual background characteristics (e.g., educational attainment, aptitude, and family status) and service environment (e.g., military occupational speciality, duty location assignments, and career turbulence) on post-training attrition. Second, we want to determine whether the correlates of post-training attrition vary across services and military occupations. For example, one might expect that if individuals were poorly matched to jobs then high school dropouts would be more likely to leave early in some jobs than in others.

The remainder of this paper is divided into three sections. Section II describes the data set used in the analysis and examines occupational differences in post-training attrition levels. Section III introduces a multivariate model of the attrition process to analyze the separate relative effects of individual characteristics, duty location,

career turbulence, and military occupation on attrition. The final section presents conclusions and suggestions for further research.

II. DATA AND PATTERNS OF POST-TRAINING ATTRITION

The FY75 Cohort File is a unique source of data for analyzing attrition behavior. Created by the Defense Manpower Data Center (DMDC), it contains information on nonprior service enlisted accessions for FY75 (October 1974 through September 1975). The file consists of a longitudinal history of these accessions and includes information from three types of personnel records: the accession record, quarterly master file records, and loss records. Thus, the file contains information on background experiences before accession, a sequence of military experiences, and status at separation from the military. It is therefore possible to trace the effects of military experiences on attrition behavior throughout the first term of enlistment.

The file contains two broad groups of variables which are likely to influence post-training attrition: individual background characteristics and recruit service experiences. Background characteristics include region of origin, race, age at entry, educational attainment, Armed Forces Qualification Test (AFQT) score, family status, and recruit entry status. Service experiences are characterized by the recruit's initial post-training duty location, final post-training duty location, military occupational specialty, and career turbulence (e.g., job reassignments and retraining).

Table 1 reveals the differences in the overall post-training attrition levels in occupational areas of the Army and Air Force.[1] The Air

[1] These five occupational area groupings were constructed from the one-digit DoD occupational area codes associated with initial Military Occupational Speciality (MOS) or Air Force Speciality Code (AFSC). The five areas are:

Force has a substantially higher post-training attrition rate than the Army (32.3 percent vs. 20.8 percent). This difference may partly reflect the fact that training attrition in the Army was 46.8 percent as compared with 9.3 percent in the Air Force. If the Army is more successful at detecting and dismissing potentially unproductive recruits during training, then the training dismissal policy has a dampening influence on post-training attrition.[2] Another reason for the higher post-training attrition rate in the Air Force is the fact that virtually all Air Force enlistments are for four years, as contrasted with a mix of three- and four-year enlistments in the Army. Since the Air Force recruits are at risk of discharge for a longer average time, the attrition rate should be somewhat higher (other factors held constant). Even after 36 months, however, the Air Force unconditional post-training attrition rate (26.4 percent) still exceeds that of the Army (20.2 percent).

In each service, attrition rates vary significantly with occupational area. In the Air Force, skilled technicians and

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- Skilled technicians (DoD codes 1-4),
- Functional support and administration (DoD code 5),
- Electrical/mechanical equipment repairmen (DoD code 6),
- Craftsmen, service and supply handlers (DoD codes 7-8), and
- Combat arms (DoD code 0).

These very broad categories of job tasks allow comparisons of post-training attrition levels across very different jobs. Attrition rates in occupational areas can also be compared across services. Much more narrow occupational (MOS and AFSC) information is included in the multivariate model estimated in Section III.

[2] Any cost-benefit comparisons of Army and Air Force attrition patterns remain ambiguous at this point. Although the Army saves on explicit training costs through attrition during training, it receives less return in the form of recruit contribution to force productivity. The Air Force completely loses the outlays for training, but presumably accrues some returns in the form of post-training productivity before attrition.

electrical/mechanical equipment repairmen have attrition rates ranging 5 to 10 percentage points lower than the other job areas. In the Army, combat arms have the highest post-training attrition rate (26.6 percent as compared with 18.4 percent for the other four areas combined).

The large variation in attrition rates across occupational areas does not imply that some occupational areas are attrition-prone. The apparent importance of occupation may be illusory if individuals predisposed to discharge early are clustered in a few occupations. For example, attrition in combat arms may be higher than in electrical/mechanical equipment repair because more attrition-prone high school dropouts are assigned to combat arms. The apparent variance in post-training attrition across occupations may also be misleading if some occupations have a disproportionate number of "bad" duty assignments. In this case, the appropriate policy option would be to revise duty assignment strategies, not necessarily to alter the relative attractiveness of seemingly attrition-prone occupations.

We turn now to a multivariate model of attrition behavior to assess the relative contribution of individual characteristics, duty location, career turbulence, and military occupation to post-training attrition. This model will allow us to sort out the separate effect of a given variable like military occupation while jointly controlling for individual characteristics and other service experiences.

III. A MULTIVARIATE ANALYSIS OF POST-TRAINING ATTRITION

ANALYSIS FRAMEWORK AND STATISTICAL METHODOLOGY

The attrition process can be viewed as an outgrowth of a reevaluation of the enlistment contract. At accession, the recruit and the service voluntarily agree to an enlistment contract for a specified term of service. Each party foresees a satisfactory relationship for the duration of the term of enlistment, but neither party can fully guarantee it. As time passes, the service accumulates evidence on the recruit's productivity, reliability, and adaptability to the military environment. The recruit gains experience with the demands and rewards of military life, and acquires skills that may enhance his opportunities in the civilian job market.

The underlying hypothesis is that recruits leave the service early either because they perceive better civilian alternatives or because the service perceives unacceptably low recruit productivity. In short, the recruit chooses to "quit" if he believes, ex ante, that his overall well-being will be enhanced. The service will dismiss ("fire") the recruit if his ex ante productivity is believed to be less than his military wage.[1] For recruits who complete their enlistment term, the hypothesis presumes that the recruit and the service perceive the completion of the enlistment contract as preferable to its dissolution.[2]

[1]The term "productivity" is used in a very broad sense to include behavior and attitude as well as direct work contributions.

[2]The attrition model is essentially a reformulation of existing economic models of permanent civilian labor turnover. See Jovanovic (1979). The focus on post-training attrition requires the additional condition that the service or recruit does not sever the contract during

Enlistment contracts differ from most civilian employment contracts in one important respect. The service requires a formal commitment to serve a given number of years; it does not allow recruits to "quit" before the obligation is completed. Hence, by definition, all attrition is service-induced. This, of course, does not imply that all early discharges are the result of inherently low recruit productivity. Rather, recruits who are dissatisfied with their enlistment contract (and want to "quit") may induce discharge by creating disruptions or intentionally reducing their productivity. As a result, attrition behavior is a combination of "quits" and "fires."[3] Consequently, we are unable to determine whether a given discharge is ultimately induced by the service or by the recruit.[4] With current data, we can only describe factors that are associated with either party becoming dissatisfied with the enlistment contract.

Empirically, the attrition process is summarized by a dichotomous dependent variable that categorizes individuals as stayers (people who

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basic and advanced individual training (AIT). During these training periods, both the service and the recruit enhance their knowledge of the value of the job match. Since the training period encompasses a number of months, the recruit and the service have a much clearer understanding of the value of the match than they did at accession. Many of the bad matches have been discovered and eliminated by the end of AIT.

[3]Civilian separations are typically categorized into quits or fires, depending on whether the separation was initiated by the employee or employer. This distinction is suspect in many cases because the costs of the two types of discharges may differ substantially. For example, a dissatisfied employee may induce his "firing" because unemployment compensation is not available to employees who quit. Similarly, some firms may encourage unproductive workers to quit because involuntary discharges typically increase the firm's contribution to state unemployment funds.

[4]The services do report reasons for each discharge, but the system for classifying reasons for discharge is inconsistently applied both across and within services. See Comptroller General (1980).

remain until the end of their service term) or leavers (individuals discharged early). For the ith individual, the outcome (Y_i) is defined to be one or zero according to whether the individual is discharged early or not. The multivariate statistical model of the attrition level relates Y_i to a vector of explanatory variables (X_i). Traditional least squares estimation procedures are inappropriate for this estimation problem because the least squares assumptions are violated when the dependent variable has a Bernoulli distribution. In particular, the variance of Y_i is not constant but is a function of the expected Y_i and the predicted values for Y_i are not constrained to lie between zero and one. These difficulties are alleviated by specifying the attrition model in a logistic functional form, where

$$P[Y_i = 1|X_i] = 1/[1 + \exp(-X_i'\beta)] \qquad (1)$$

represents the contribution to sample likelihood of leavers, and

$$P[Y_i = 0|X_i] = \exp(-X_i'\beta)/[1 + \exp(-X_i'\beta)] \qquad (2)$$

represents the contribution to sample likelihood of stayers. In this model, X_i is a $(k + 1) \times 1$ vector, β is a $(k + 1) \times 1$ vector of estimated parameters, and k denotes the number of estimated characteristics for each individual.

Two estimation methods are commonly used to estimate the parameters in studies of this type: conditional maximum likelihood estimation and discriminant function analysis. Since several empirical studies (Chow (1980), Haggstrom (1974), Halperin, Blackwelder, and Vorter (1971)) report

similar estimates with both methods, we chose the cheaper, discriminant function method.

The linear discriminant specification of a logistic attrition model is

$$\lambda(X) = \ell n[P(X)/(1 - P(X))] = X\beta \; ; \qquad (3)$$

i.e., the natural logarithm of the odds ratio is a linear function of X. The estimated coefficients are derived by rescaling the least squares coefficients relating Y and X. A more intuitive interpretation of the β coefficients considers the derivative of the probability function (evaluated at the mean attrition probability) with respect to the jth characteristic. This derivative equals

$$\beta_i P(1 - P), \qquad (4)$$

where P represents the mean attrition probability. The derivative approximates the effect of each explanatory variable on the average attrition probability (within the relevant occupational area) while holding constant the effect of other X variables.

The remainder of this section presents results from the estimation of the multivariate post-training attrition model. The discriminant regression coefficients are translated into probabilities using Equation 4 and reported in Tables 2 through 7. The model is estimated separately for each occupational area in each service. Variables are included to control for the recruit's region of origin, race, age at entry, educational attainment, AFQT test score, family status, entry status, initial post-training duty location, final post-training duty location, and career turbulence. Coefficients are also estimated for a set of indica-

tor variables in each occupational area which represent very specific three-digit AFSC and MOS occupations. This finer occupational control is imposed to determine whether the experiences associated with occupational specialties significantly alter overall attrition levels in the occupational area. This methodology allows us to analyze the effects of individual characteristics, duty location, and career turbulence on attrition levels across occupational areas in each service, and compare parameter estimates of similar occupational areas across services.

THE RELATIVE IMPORTANCE OF INDIVIDUAL CHARACTERISTICS

Individual characteristics are likely to influence attrition probability for three reasons. First, some characteristics may represent a taste for military life or environment. Second, some attributes, such as education or mental category, may constrain the recruit's ability to achieve proficiency in a military occupation. Finally, individual characteristics may affect the recruit's perception of the value of civilian opportunities such as wages and the probability of finding a job. Some or all of these factors shape a characteristic's relative contribution to attrition.[5]

Tables 2 and 3 show how post-training attrition rates in the Army and Air Force vary with individual characteristics, while controlling for duty location assignments and military occupation.

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[5]In some cases, several of these types of explanations may underlie the relationship between a given individual characteristic and attrition. In these cases, the underlying mechanism cannot be identified. As a result, we cannot suggest policy prescriptions.

First-term enlisted recruits for the Army and Air Force are drawn disproportionately from the South. This overrepresentation may indicate an underlying taste for military life in the South. Alternatively, studies of civilian wages (Smith and Welch (1975, 1978)) reveal substantially lower wages in Southern states, which would tend to enhance the military's attractiveness to Southern youths. In either case, it would be reasonable to expect recruits from the South to have a lower attrition rate than those from other regions, but the regression results generally refute this hypothesis. The effect of region of origin on attrition probability is negligible in virtually all occupational areas. The exception is functional support and administration in the Air Force, where recruits from the North Central and West are 3 to 5 percent more likely to leave than recruits from the South.

Recruits who enter the Army before reaching age 18 are 5 to 7 percent less likely to complete their enlistment term than are recruits 18 and older. These young, presumably less mature, recruits do not have attrition problems, however, in the craftsmen, service, and supply handlers occupational group in the Army. The Air Force has fewer attrition problems with young recruits: Recruits under 18 at entry are significantly more likely to leave early only in the craftsmen, service, and supply handlers occupational area--exactly the opposite of the Army.

Recruits over 18 years of age typically have the same attrition tendencies as the 18-year-old modal group. Only rarely are the variable coefficients for recruits older than 18 significant, and in each case the effect is negative. In these cases, older recruit attrition is 2.5 to 4 percent less likely in comparison with 18-year-olds.

Recruits without high school diplomas are much more likely to leave early in all occupational areas in both services. They have demonstrated some level of skill proficiency by completing advanced skill training, but their job performance or behavior is ultimately unsatisfactory.[6] Failure to complete high school may reflect attitudinal or behavior problems or signal low ability or aptitude for the service job. It would be interesting to determine whether nongraduates who complete advanced training are marginal or average trainees. If nongraduates are able to compete equally with graduates in advanced skill training and still have an increased chance of early discharge, then educational attainment is a proxy for factors ultimately creating attitudinal or behavior problems in the military. Alternatively, if nongraduates are deficient in their ability to acquire military skills in training, then educational attainment is probably an indication of the individual's underlying ability to perform in a military career. In the former case, we would hypothesize that dropouts are less able than graduates to cope with the military environment. This type of attrition could be attenuated by different policies of discipline or counseling. In the latter case of inadequate ability, the primary policy tool to reduce post-training attrition is to recruit fewer dropouts (lower overall attrition) or to raise the proficiency standards for completion of advanced training (increase the training attrition of dropouts and reduce the post-training attrition). The policy choice, of course,

[6]Nongraduates may have inherent tendencies for low job performance or disruptive behavior. Alternatively, some nongraduates may intentionally reduce job performance and create disruptions because they want to "quit" by inducing early discharge.

would depend on the costs of the various alternatives and the value of attrition as a management tool.

Race is one characteristic that is not correlated with attrition. Blacks are 2.6 percent less likely to leave early if their military occupation is in the area of functional support and administration in the Air Force. The attrition rate for blacks in the combat area of the Army is about 4 percent lower than for whites. In all other job areas in both services, blacks and whites have almost the same attrition probabilities.

Mental test group does not appear to be an important correlate of post-training attrition level in most occupational areas in the Army and Air Force. The Air Force exceptions are a 9.1 percent lower attrition rate for Category I than for Category II in the electrical/mechanical equipment repair area and a 1.8 percent higher attrition rate for Categories IIIB and IV than for Category II in the craftsmen, service, and supply handlers area. Mental test ability is notably more important in Army combat arms, where Category IIIA, IIIB, and IV recruits are 2.7 to 3.5 percent more likely to leave than Category II recruits.

The limited importance of mental ability in the multivariate attrition model is in contrast with the significant simple correlation between mental test ability and post-training attrition. Test ability has the anticipated negative correlation with attrition in those cases where the variables are significant, but the relative importance of test ability is dominated by other variables in the multivariate model. The implication is that mental test ability (measured by AFQT) is not a good predictor of post-training attrition in most job areas in the Army and Air Force.

The last group of individual characteristics in the multivariate model are indications of the family status of the individual at the completion of training. The results indicate that recruits who are married at the end of training are 3 to 8 percent less likely than single recruits to leave early. Likely reasons are the added responsibilities of married recruits, their possibly greater maturity, and the higher financial allowances they receive.

The inhibiting influence of marriage on attrition is offset by the presence of children. The dependents variable is significantly positive and contributes to attrition in five of the nine occupational areas. The implication is that married recruits with children are more likely to leave than married recruits with no children. Frequently, in fact, married recruits with children are as likely to leave as single recruits.

In general, the correlations between individual characteristics and attrition in our multivariate model are similar across occupational areas and across both services. While the attrition level varies substantially across occupational areas and service, the relative contribution of a given characteristic, e.g., educational attainment, to the attrition level is very similar to that of the others. This suggests that overall attrition cannot be attenuated through reassignment of recruits with certain characteristics to occupations where these attributes are less highly correlated with attrition. For instance, if we found that a high school diploma were positively correlated with attrition in maintenance jobs but negatively correlated with attrition in

supply, it might be possible to channel more educated recruits into supply and thus reduce overall attrition. However, our results suggest that this type of reassignment scheme may not substantially reduce post-training attrition in the Army or Air Force, because individual characteristics tend to have similar effects on attrition in different occupational areas.[7]

THE RELATIVE IMPORTANCE OF DEP AND TERM OF SERVICE

Table 4 shows that delayed entry program (DEP) participants are less likely to experience early discharge than nonparticipants.[8] Recruits who spend more than three months in DEP are significantly more likely than nonparticipants to complete their enlistment term in all occupational areas of each service. The magnitude of the reduction varies in the Air Force from 4.9 percent for skilled technicians to 11.1 percent for electrical/mechanical equipment repairmen. In the Army, the reduction varies from 6.0 percent for electrical/mechanical equipment repairmen to 10.0 percent for combat arms jobs. One-to-three-month DEP participation also reduces attrition in most job areas, but the size of the reduction is smaller than for recruits who remain in DEP past three months.

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[7]In Navy research on attrition, Thomason (1979) has argued that this type of reassignment scheme would reduce attrition by about 6 percent. He found that individual characteristics had quite different effects on attrition in different rating groups.

[8] Under DEP, the services allow a recruit to wait up to twelve months after enlistment before active duty. The delay typically occurs either to await openings in a given service occupation or for the recruit to take some leisure or finish school before entering the service.

Since the model controls for individual job assignments, waiting for universally perceived "better" jobs does not explain significantly lower attrition among DEP participants.[9] Rather, recruits may have different tastes or skills for military jobs, and months in DEP signals a better match of individuals with subsequent assignment. Alternatively, months in DEP may indicate greater maturity and career planning, either because the program appeals to the circumspect recruit or because hesitant and uncertain recruits tend to select out and not report for service. Although all these explanations suggest a negative relation between DEP and attrition, it is impossible to distinguish among the competing hypotheses.

In the Army equations, term of service was introduced to contrast three- and four-year enlistments. Since four-year enlistees are at risk for a longer period of time (that is, the cost of a mistake at recruitment is increased), the expected sign of this variable's coefficient (indicating a four-year contract) is positive after other characteristics and experiences are controlled. The expectation is confirmed, but the magnitude of the coefficients implies that four-year enlistees are more likely to leave during the first three years of their term than are three-year enlistees. In two groups, for example--functional support and administration, and craftsmen, service, and supply handlers--four-year enlistees are 12.7 percent and 13.1 percent more likely to leave than three-year enlistees. Since only 2.8 percent of the four-year enlistees leave during the fourth year in the Army, we can surmise that

[9] While the combat arms area is typically not considered particularly desirable, DEP participants still have a substantially lower post-training attrition level than non-participants.

many of them must be leaving before the end of the third year of service.

THE RELATIVE IMPORTANCE OF DUTY LOCATION

Duty location unambiguously alters the likelihood of attrition after controlling for individual characteristics and occupation. Duty location added significantly to the explanatory power of the multivariate model in each occupational area of the Army and Air Force. F-tests were computed for each equation comparing the unconstrained residual sum of squares (including duty location variables) with the constrained residual sum of squares (where the location parameters are constrained to equal zero). In all cases, the F-statistic was significant at the 5 percent confidence level. Consequently, the observed variability in attrition rates by duty location is not a statistical artifact created by a nonrandom assignment of individuals to locations based on age, education, mental category, or other observed individual characteristics. Tables 5 and 6 show the variance in post-training attrition rate by location.

From a policy perspective, we would like to assess the underlying reasons for the significant relative effect of duty location on post-training attrition. Three broad operating mechanisms are consistent with the observed result:

- o Environmental: Some locations may be inherently more or less attractive to recruits irrespective of their military jobs.
- o Vocational: Locations may differ substantially in the opportunities or work environments associated with a given job assignment.

- o Command: The command structures and attrition policies may vary significantly with location.

Some or all of these factors contribute to the observed attrition variance.

The competing explanations for attrition differences by location have different implications for attrition management. If the differences were largely caused by environmental factors, then these attrition costs are implied by the overall manning configuration. Vocational differences could be reduced by policies enhancing the attractiveness of attrition-prone vocational sites. Finally, if command factors are responsible for the observed variance in attrition levels by location, policies could be designed to identify and introduce the effective attrition management approaches systemwide.

Current data are not well suited to disentangle the separate effects of environmental, vocational, and command factors on attrition behavior, because we are not able to directly control these factors. Nonetheless, we may be able to gain some insights from observing the pattern of location effects across occupational areas and services. For instance, although command factors probably vary with occupational area and service, the effect of environmental factors should be relatively insensitive to occupational area and service branch. If vocational factors predominate, the effects of a given location on attrition will vary with occupational area. In comparing occupational areas of different services, vocational factors could have similar or different attrition effects on a given location, depending on whether vocational factors

were location-specific or service-specific. Thus, a comparison of location effects across occupational areas and services has implications for the interpretation of location effects on attrition. Unfortunately, such comparisons cannot distinguish vocational and command factors.

In the Army, the effects of first location assignment on Army attrition are not systematic across occupational groups. CONUS sites are indistinguishable for nearly all occupational groups. The exception is initial duty assignment in the West, which tends to increase attrition by about 4 percent in the electrical/mechanical equipment repair and combat arms specialties. Interestingly, Europe has opposing effects depending on occupational group; it increases attrition by 5.8 percent in functional support and administration but reduces it by 3.7 percent in combat arms. The Pacific is significantly negative for three occupational groups and tends to reduce attrition by 4 to 6 percent.

The last Army duty assignment is more consequential than the first, and the attrition rates again vary across occupational groups. Recruits whose last duty assignment is in the Northeast or North Central divisions are 9 percent more likely to leave early than those stationed in the South. The coefficient on Europe is significantly negative for skilled technicians, functional support and administration, and electrical/mechanical equipment repairmen. Final European assignment increases the attrition probability by 6 percent in the craftsmen, service, and supply handler specialties. The Pacific has a positive influence on attrition in the craftsmen, service, and supply handler and combat arms occupational groups.

The overall pattern of relative duty-location effects in the Army is anything but systematic. Locations have differing effects in different job groups, and a given location occasionally has differing effects for first and last duty assignments. To investigate the sensitivity of the location specification, different specifications of the multivariate model were estimated using first and last location variables separately. These results indicated that the overall qualitative effects of the multivariate model are relatively insensitive to a respecification of the location variables.

One interpretation consistent with the Army results is that the significant explanatory power of duty location variables derives either from differences in local command variables or differences in vocational factors. This inference follows from the different effects a given location has on attrition rates among occupational groups. If some locations were simply environmentally attractive, then the inhibiting influence on attrition should be relatively uniform.

In contrast to the Army, relative location effects in the Air Force are qualitatively invariant with occupational area. Except for the craftsmen, service, and supply handler group, there is little distinction among the effects of CONUS first duty location sites on attrition. Also, initial assignments in Europe or the Pacific tend to reduce the likelihood of attrition by 5 to 9 percent in half the occupation groups.

The effects of last Air Force duty location are much more pronounced than the first location variables, however. In each of the four occupational groups, final assignment in the North Central division significantly increases the attrition probability relative to the South.

European or Pacific last assignments are associated with lower attrition in all job groups; the size of the effect ranges from 6 to 27 percent. The European and Pacific effects vary in magnitude substantially across job groups. Skilled technicians assigned to Europe or the Pacific have much smaller reductions in their relative attrition level than do craftsmen, service, and supply handlers assigned to Europe or the Pacific.

When alternative specifications of Air Force duty location were tried in the multivariate model, the overall qualitative results were unaffected. When first location is entered separately, North Central is significantly positive, and Europe and Pacific are significantly negative. These results are repeated when last location is entered separately. The similar pattern of location effects across occupational groups is consistent with the hypothesis that Europe and the Pacific are more attractive by environmental criteria. Air Force recruits assigned to the North Central region, on the other hand, are relatively more likely to leave than other CONUS recruits, after controlling for background characteristics and occupation.

THE RELATIVE IMPORTANCE OF CAREER TURBULENCE

Disruptions in a recruit's work environment can be characterized as career turbulence. Turbulence can take the form of occupational reassignment, retraining, or mere temporary absence from the recruit's military occupation. Turbulence may reduce a recruit's satisfaction or productivity, or both, and consequently enhance his probability of discharge. Unfortunately, current data do not allow us to distinguish

between involuntary and voluntary career changes. When a recruit leaves one specialty for another, for example, there is no way of knowing whether his ability was inadequate for the first job, whether he was involuntarily reassigned because of changing military requirements, or whether he chose to leave the first job for one he believed more attractive.[10] Table 7 reveals how post-training attrition rates vary by various measures of career turbulence.

Reassignments to jobs that recruits have not been trained for may also alter the attrition probability. DODCHA (DoD change of occupational assignment) indicates whether the recruit's last duty occupation corresponds to his last primary (trained) occupation. Since this variable may reveal mismatching associated with a man's working in a job other than his trained specialty, one might anticipate a positive relation between DODCHA and attrition. But DODCHA has the predicted positive sign in only one occupational area and is generally significantly negative. Taken at face value, the result suggests that DODCHA indicates that recruits have volunteered for duty in a more desirable job or one with more career potential.

The final career change variable in the multivariate model also concerns job mismatching. Should a recruit be assigned to an occupation where he is not productive or satisfied, he may be retrained in another specialty. This is reflected in a change of MOS or AFSC; accordingly, an indicator variable, MOSCHA (MOS change), has been defined to

[10]If the perceived "turbulence" reflects recruit choices for career changes, then the turbulence variables are endogenous. While the endogeneity problem complicates the interpretation of the turbulence coefficients, the other regression coefficients are insensitive to the inclusion of the turbulence variables.

designate recruits who are retrained. To the extent that MOSCHA indicates job mismatching, the expected relationship between MOSCHA and attrition is positive. Alternatively, if the recruit is better suited to the new job than the first, then MOSCHA may inhibit attrition. Empirically, the effect of MOSCHA on attrition is haphazard: The coefficient is insignificant in four equations, significantly positive in two, and significantly negative in two. A possible explanation for the negative coefficients is that some productive recruits seek retraining in a new field to further their inservice career opportunities.

Changes in a recruit's military career induced by disciplinary infractions are likely to increase the possibility of attrition. A variable indicating whether the end of the man's enlistment term was adjusted backward after accession is BASDCHA (Base Active Service Date Change). These adjustments are typically made to account for time in military prison, in desertion, or AWOL. In short, BASDCHA designates men who have some history of serious disciplinary infractions but are not immediately discharged for the violation. If a serious infraction was a transient event in a recruit's military career, BASDCHA will have no effect on attrition. It is more likely, however, that serious misconduct indicates chronic behavior problems that heighten the chances of early discharge; in this case, the predicted sign for BASDCHA is positive.

In the multivariate model for the Army, the BASDCHA coefficient is significant and positive for all groups but skilled technicians. In the Air Force, recruits are about 35 percent more likely to leave if their active base service date has been adjusted. This may be compared with a

figure of 16 percent for an Army recruit. While these results tend to corroborate the chronic delinquency hypothesis, a change in the base active service date is by no means synonymous with early discharge.

THE RELATIVE IMPORTANCE OF MILITARY OCCUPATION

A further question is whether military occupation is correlated with the level of attrition after controlling for individual characteristics, duty location, and career turbulence. The multivariate attrition model provides a two-part answer. First, attrition levels vary across occupational groups in the Army and Air Force. If the multivariate specification is pooled across occupational groups, indicator variables designating occupational groups contribute significantly to the model's explanatory power. This result suggests that the inservice experiences associated with an occupation may significantly alter the likelihood of attrition after controlling for the differences in individual characteristics, duty location, and career turbulence. Table 8 shows the predicted post-training attrition levels assuming that individuals were distributed across occupational areas without regard to their individual characteristics, duty location assignments, or career turbulence. The overall attrition level in combat arms is still substantially higher than in all other Army occupational areas. In the Air Force, the functional support and administration area and the craftsmen, service, and supply handler area have post-training attrition levels about 7 to 9 percentage points higher than the other occupational areas. For example, according to our model, an Air Force recruit who is a skilled technician is about 8.8 percent more likely to leave early than

a recruit with the same individual characteristics, duty locations, and career changes, but whose occupation is in the craftsmen, service, and supply handler group.

In addition to the broad comparisons of occupational areas, the multivariate attrition model facilitates attrition comparisons of specific occupational specialties within occupational groups. In six of the nine groups, a set of indicator variables designating individual MOS or AFSC was significant at the 5 percent confidence level.[11]

In other words, within an occupational area, recruits with identical individual characteristics, duty locations, and career changes will generally have different predicted attrition probabilities, if they are assigned to different military specialties.

In some groups, however, the set of military specialty variables is not significantly correlated with the overall attrition rate. The group of occupation variables is insignificant for functional support and administration and for combat arms in the Army, and for craftsmen, service, and supply handlers in the Air Force. The observed, unconditional differences in attrition by occupation within these job areas are correlated with the background characteristics and duty locations of individuals in these jobs. In combat arms, for example, infantrymen are 7.3 percent more likely to leave early than Pershing missile crewmen, but the difference vanishes when we control for other characteristics of individuals in these occupations. According to our model, a recruit's

[11]F-tests are computed for each equation, comparing the unconstrained residual sum of squares (including occupation dummies) with the constrained residual sum of squares (where the occupation parameters are set equal to zero).

specific job in combat arms has no significant influence on his attrition probability.

IV. CONCLUSIONS

In this research, a multivariate model of the attrition process has been developed to describe the effects of individual background characteristics, duty location assignments, career turbulence, and military occupational assignments on post-training attrition. The research suggests that military occupation and duty location are significantly correlated with post-training attrition, after controlling for individual characteristics. The role of career turbulence is unclear; more meaningful measures of turbulence are required than those available at this time. Among individual characteristics, the research demonstrates that high school graduates have much lower post-training attrition rates than nongraduates. The research also indicates that mental test category is not related to attrition after controlling for other background and inservice experience variables. Participation in a delayed entry program (DEP) prior to entering the military tends to reduce substantially the likelihood of attrition. Married recruits are less likely to leave early than single recruits, but the presence of children enhances attrition.

In general, individual characteristics tend to have consistent qualitative and quantitative implications for attrition across occupational groups in the Army and Air Force. Army combat arms are somewhat anomalous, in that individual characteristics such as mental test category and race, which have no influence on attrition in most occupational areas, are significantly correlated with attrition from combat jobs.

These results imply four policy conclusions. First, the similar effects of individual characteristics on attrition in most occupational groups suggest that overall post-training attrition cannot be attenuated by reassigning recruits with certain characteristics to occupations where these characteristics are less positively correlated with attrition. Second, the importance of individual characteristics on post-training attrition indicates that the overall attrition level could be reduced by more stringent accession screens. The costs of meeting current force requirements with more stringent screens may be prohibitively expensive, however; the services would probably have to devote more time, money, and personnel to recruiting, screen more applicants, and offer more generous enlistment incentives. Third, attrition does vary by location, and attrition management may be facilitated by changing personnel practices to reduce the incentives to leave these work environments. Finally, attrition also varies by occupation, and the overall attrition level could be reduced by either altering the mix of military occupations held or enhancing the attractiveness of high-attrition occupations.

These results suggest that it would be useful to conduct more detailed field and survey analysis into attrition-related aspects of certain occupations and locations. Further analysis is needed to identify what factors precipitate unusually high (or low) attrition levels in different locations or occupations. To the extent that attrition differences are related to military programs and facilities, attrition management policies could be designed to replicate desirable factors and reduce overall attrition levels.

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Table 1

ATTRITION RATES BY OCCUPATIONAL AREAS
IN THE ARMY AND AIR FORCE

(In percent)

Occupational Area	Army		Air Force	
	Attrition	% of Cohort in Occupation	Attrition	% of Cohort in Occupation
Skilled technicians	17.2	9.2	26.8	23.2
Functional support and administration	17.8	11.3	35.7	19.2
Electrical/mechanical equipment repairmen	19.8	16.0	31.1	25.7
Craftsmen, service, and supply handlers	18.1	12.2	36.6	25.7
Combat arms	26.6	37.6	--	--
Total	20.8	86.3[a]	32.3	93.8[a]

[a]Occupations with 0.2 percent or less of cohort were excluded.

Table 2

RELATIVE PERCENTAGE CONTRIBUTION OF INDIVIDUAL CHARACTERISTICS TO POST-TRAINING ATTRITION IN THE ARMY

Characteristic	Skilled Techs	Support & Admin	Elect/ Mech Equip Repair	Crafts, Service & Supply	Combat Arms
Region of Origin					
Northeast	2.1	1.8	-1.2	-1.1	1.2
North Central	0.2	3.1	2.0	-1.5	1.9
West	1.6	3.7*	1.4	2.0	1.9
South	--	--	--	--	--
Age at Accession					
Age LT 18	7.0*	4.6*	6.0*	1.7	4.8*
Age EQ 18	--	--	--	--	--
Age EQ 19	0.4	-2.6	-0.2	-3.9*	0.7
Age GT 19	-0.8	-3.4*	-0.6	-2.3	0.5
Educational Level					
Not HS grad	14.7*	15.9*	15.6*	18.9*	17.6*
Grad equiv diploma	11.3*	11.8*	10.9*	13.9*	18.6*
HS grad	--	--	--	--	--
Some post HS	-1.5	-0.4	1.3	-2.9	-0.6
Race					
Black	-1.2	2.2	-1.3	-0.5	-4.0*
White	--	--	--	--	--
AFQT Mental Category					
Category I	-6.0	-2.0	-5.2	3.8	-3.0
Category II	--	--	--	--	--
Category IIIA	0.0	-0.5	-0.3	1.7	2.9*
Category IIIB	-1.1	1.2	0.5	3.5*	2.7*
Category IV	1.3	-0.7	2.7	4.8*	3.5
Family Status after AIT					
Married	-4.7*	-3.9*	-6.1*	-3.8*	-3.4*
Single	--	--	--	--	--
More than 2 dependents	1.8	7.7*	3.8*	0.4	2.1
No extra dependents	--	--	--	--	--

NOTES: Each entry represents the percentage difference relative to the reference group, evaluated at the mean post-training attrition rate in each respective occupational area. The reference group in each category has a dashed entry.

Starred entries are associated with discriminant regression coefficients that are significantly different from zero.

Table 3

RELATIVE PERCENTAGE CONTRIBUTION OF INDIVIDUAL CHARACTERISTICS TO POST-TRAINING ATTRITION IN THE AIR FORCE

Characteristic	Skilled Techs	Support & Admin	Elect/ Mech Equip Repair	Crafts, Service & Supply
Region of Origin				
Northeast	0.7	3.0	-0.3	1.5
North Central	-0.4	3.1*	1.5	-0.4
West	-0.5	4.5	-2.2	-1.6
South	--	--	--	--
Age at Accession				
Age LT 18	-0.1	2.1	2.9	5.3*
Age EQ 18	--	--	--	--
Age EQ 19	-1.8	-0.1	-2.6*	-1.3
Age GT 19	-0.9	-1.9	-1.7	-0.9
Education Level				
Not HS grad	12.6*	11.0*	14.0*	16.7*
Grad equiv diploma	9.5*	17.1*	12.5*	17.8*
HS grad	--	--	--	--
Some post HS	-3.4	-2.2	3.1	-10.8*
Race				
Black	-1.6	-2.8*	-1.7	-0.9
White	--	--	--	--
AFQT Mental Category				
Category I	-2.0	-5.4	-9.1*	-2.1
Category II	--	--	--	--
Category IIIA	1.1	-0.4	-0.5	0.3
Category IIIB and IV	2.0	-1.6	-0.3	1.8
Family Status after AIT				
Married	-4.3*	-6.3*	-7.8*	-6.1*
Single	--	--	--	--
More than 2 dependents	4.5*	5.2*	2.0	-0.7
No extra dependents	--	--	--	--

NOTES: Each entry represents the percentage difference relative to the reference group, evaluated at the mean post-training attrition rate in each respective occupational area. The reference group in each category has a dashed entry.

Starred entries are associated with discriminant regression coefficients that are significantly different from zero.

Table 4

RELATIVE CONTRIBUTION OF SERVICE ENTRY STATUS
TO POST-TRAINING ATTRITION

DEP Status	Skilled Techs	Support & Admin	Elect/ Mech Equip Repair	Crafts, Service & Supply	Combat Arms
Army Results					
No DEP	--	--	--	--	--
1-3 months in DEP	-5.0*	-4.4*	-3.4*	-1.7	-4.2*
DEP GT 3 months	-8.4*	-7.2*	-6.0*	-6.9*	-10.0*
Three-year term	--	--	--	--	--
Four-year term	7.6*	12.7*	3.9*	13.1*	7.3*
Air Force Results					
No DEP	--	--	--	--	
1-3 months in DEP	-1.8	-3.4*	-5.8*	-1.7	
DEP GT 3 months	-4.9*	-7.2*	-11.1*	-8.8*	

NOTES: Each entry represents the percentage difference relative to the reference group, evaluated at the mean post-training attrition rate in each respective occupational area. The reference group in each category has a dashed entry.

Starred entries are associated with discriminant regression coefficients that are significantly different from zero.

Table 5

RELATIVE CONTRIBUTION OF INITIAL POST-TRAINING DUTY LOCATION TO POST-TRAINING ATTRITION

Duty Location	Skilled Techs	Support & Admin	Mech Equip Repair	Elect/ Crafts, Service & Supply	Combat Arms
Army Results					
CONUS					
Northeast	3.9	3.8	-2.3	2.7	-0.7
North Central	2.0	-0.5	(a)	-3.7	(a)
South	--	--	--	--	--
West	2.5	1.5	4.6*	-1.2	4.1*
Europe	3.1	5.8*	2.6	1.9	-3.7*
Pacific	-5.8*	-3.2	-4.2*	-6.5*	-6.5*
Air Force Results					
CONUS					
Northeast	-3.9	0.4	1.8	5.0	
North Central	0.4	-3.2	-0.4	4.1*	
South	--	--	--	--	
West	0.4	1.9	1.0	2.6	
Europe	1.2	-8.7*	-2.9	-5.0	
Pacific	-4.8*	-4.0	-2.8	-9.0*	

NOTES: Each entry represents the percentage difference relative to the reference group, evaluated at the mean post-training attrition rate in each respective occupational area. The reference group in each category has a dashed entry.

Starred entries are associated with discriminant regression coefficients that are significantly different from zero.

[a]Data for North Central were merged with those for Northeast because of the small number of observations in the separate categories.

Table 6

RELATIVE CONTRIBUTION OF FINAL POST-TRAINING DUTY LOCATION TO POST-TRAINING ATTRITION

Duty Location	Skilled Techs	Support & Admin	Elect/ Mech Equip Repair	Crafts, Service & Supply	Combat Arms
Army Results					
CONUS					
Northeast	-4.4	-3.2	8.8*	5.2	8.5*
North Central	-5.3	-1.4	(a)	9.1*	(a)
South	--	--	--	--	--
West	1.1	1.8	-0.3	4.2	-0.7
Europe	-8.0*	-10.5*	-5.5*	-6.0*	1.0
Pacific	3.2	1.3	-2.8	6.0*	5.9*
Air Force Results					
CONUS					
Northeast	-0.3	-2.3	-0.8	-1.1	
North Central	6.0*	10.1*	7.4*	3.1	
South	--	--	--	--	
West	1.3	-1.2	-0.2	1.5	
Europe	-13.7*	-20.1*	-14.0*	-22.9*	
Pacific	-8.0*	-23.5*	-17.8*	-27.7*	

NOTES: Each entry represents the percentage difference relative to the reference group, evaluated at the mean post-training attrition rate in each respective occupational area. The reference group in each category has a dashed entry.

Starred entries are associated with discriminant regression coefficients that are significantly different from zero.

[a]Data for North Central were merged with those for Northeast because of the small number of observations in the separate categories.

Table 7

RELATIVE CONTRIBUTION OF CAREER TURBULENCE
TO POST-TRAINING ATTRITION

Change	Skilled Techs	Support & Admin	Elect/ Mech Equip Repair	Crafts, Service & Supply	Combat Arms
Army Results					
MOS change	-5.5	-4.5	-4.9	9.4*	-14.0*
No MOS change	--	--	--	--	--
DOD change[a]	-7.9*	1.5	-3.2	-15.5*	-0.7
No DOD change	--	--	--	--	--
BASD change[b]	3.6	14.1*	17.4*	15.4*	17.4*
No BASD change	--	--	--	--	--
Air Force Results					
MOS change	-10.5*	27.0*	-16.6*	- 1.7	
No MOS change	--	--	--	--	
DOD change	2.7	-67.3*	15.2*	-35.9*	
No DOD change	--	--	--	--	
BASD change	34.2*	36.2*	37.0*	32.5*	
No BASD change	--	--	--	--	

NOTES: Each entry represents the percentage difference relative to the reference group, evaluated at the mean post-training attrition rate in each respective occupational area. The reference group in each category has a dashed entry.

Starred entries are associated with discriminant regression coefficients that are significantly different from zero.

[a]Change in occupational assignment.

[b]Base active service date change.

Table 8

CONDITIONAL POST-TRAINING ATTRITION LEVELS BY OCCUPATIONAL AREA IN THE ARMY AND AIR FORCE

(In percent)

Occupational Area	Army	Air Force
Skilled technicians	20.3	29.0
Functional support and administration	20.5	35.5
Electrical/mechanical equipment repairmen	19.3	28.1
Craftsmen, service, and supply handlers	21.2	37.8
Combat arms	24.2	
Total	20.8	32.3

NOTE: Each entry represents the predicted probability of post-training attrition in the occupational area while jointly controlling for the individual characteristics, duty location assignments, and career turbulence of individuals assigned to those job areas.